

CLAIMS

What is claimed:

Sub A24
A method for transmitting an OFDM signal via a channel to facilitate receiver synchronization comprising:

transforming a series of frequency domain data symbols into a burst of time domain symbols;

appending to a beginning of said time domain burst a cyclic prefix duplicating a last segment of said time domain burst, wherein said cyclic prefix includes a first portion having length v wherein v is greater than or equal to an impulse response of said channel; and further includes a second portion after said first portion to facilitate receiver synchronization; and

transmitting said data burst with said appended cyclic prefix.

2. A method for transmitting an OFDM signal to facilitate receiver synchronization comprising:

developing a frequency domain burst wherein periodically spaced frequency domain symbols of said burst have values including non-zero values and frequency domain symbols between said periodically spaced frequency domain symbols have null energy; and

transmitting said frequency domain burst.

Sub A31
A method for synchronizing to a received OFDM signal comprising:

receiving successive OFDM bursts wherein each of said bursts includes in the time domain, a series of N time domain symbols, a cyclic prefix duplicating a last segment of said series of N time domain symbols, wherein said cyclic prefix includes a first portion having length ν wherein ν is greater than or equal to an impulse response of said channel; and further includes a second portion after said first portion to facilitate receiver synchronization;

evaluating a first cost function over said successive OFDM bursts that varies depending on receiver burst timing alignment to said successive OFDM bursts; and

setting said burst timing alignment to optimize said first cost function, thereby synchronizing receiver burst timing to transmitter burst timing.

4. The method of claim 3 wherein said first cost function evaluates degree of match between said second portion of cyclic prefix and a corresponding portion of said N time domain symbols.

5. The method of claim 3 wherein said first portion of said cyclic prefix has initially unknown length, said first cost function varies depending on said length and said setting step further varies said cyclic prefix length to optimize said first cost function.

6. The method of claim 3 wherein setting comprises:

determining an optimal burst timing that will be optimal for all channel impulse response durations up to ν .

7. The method of claim 3 further comprising:

determining a fractional component of a receiver frequency alignment as measured in a unit defined by spectral width of a single OFDM frequency domain symbol based on said burst

timing alignment as varied to optimize said first cost function and on a second cost function that varies according to frequency alignment.

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8. The method of claim 7 wherein each of said OFDM bursts include frequency domain training symbols at predetermined positions and having predetermined values; and further comprising:

setting said integer component of said receiver frequency alignment so that said frequency domain training symbols are received at their predetermined positions.

9. A method for synchronizing a receiver to an OFDM signal comprising:

receiving at least one synchronization OFDM burst wherein periodically spaced frequency domain symbols of said bursts have predetermined values and tones between said periodically spaced periodically spaced frequency domain symbols have null energy;

evaluating a first cost function that varies depending on burst timing alignment, said first cost function measuring time domain periodicity of said synchronization OFDM burst; and

setting said burst timing alignment to optimize said first cost function.

10. The method of claim 11 further comprising

computing a receiver frequency offset based on said burst timing alignment as optimized by said setting step.

11. A method for synchronizing a receiver to an OFDM signal comprising:

receiving at least one OFDM synchronization burst wherein periodically spaced frequency domain symbols of said burst have values including non-zero values and frequency

domain symbols between said periodically spaced frequency domain symbols have null energy;
and

determining burst timing alignment and frequency offset responsive to optimization of cost functions determined in response to contents of said at least one OFDM synchronization burst.

12. A system for transmitting an OFDM signal via a channel to facilitate receiver synchronization comprising:

a transforming stage that transforms a series of frequency domain data symbols into a burst of time domain symbols; and

a cyclic prefix appending stage that appends to a beginning of said time domain burst a cyclic prefix duplicating a last segment of said time domain burst, wherein said cyclic prefix includes a first portion having length v wherein v is greater than or equal to an impulse response of said channel; and further includes a second portion after said first portion to facilitate receiver synchronization.

13. The system of claim 12 further comprising:

a transmission stage that transmits said data burst with said appended cyclic prefix.

14. A system for transmitting an OFDM signal to facilitate receiver synchronization comprising:

a synchronization burst generation stage that develops a frequency domain burst wherein periodically spaced frequency domain symbols of said burst have values including non-zero

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values and frequency domain symbols between said periodically spaced frequency domain symbols have null energy; and

a transform processing stage that transforms said frequency domain burst into a time domain burst.

15. The system of claim 14 wherein at least one of said periodically spaced frequency domain symbols carries data.

Sub A6 16. A system for synchronizing to a received OFDM signal comprising:

an OFDM reception system that receives OFDM bursts wherein each of said bursts includes in the time domain, a series of N time domain symbols, a cyclic prefix duplicating a last segment of said series of N time domain symbols, wherein said cyclic prefix includes a first portion having length v wherein v is greater than or equal to an impulse response of said channel; and further includes a second portion after said first portion to facilitate receiver synchronization; and

a synchronization system that evaluates a first cost function over said successive OFDM bursts that varies depending on receiver burst timing alignment to said successive OFDM bursts; and that sets said burst timing alignment to optimize said first cost function, thereby synchronizing receiver burst timing to transmitter burst timing.

17. The system of claim 16 wherein said first cost function evaluates degree of match between said second portion of cyclic prefix and a corresponding portion of said N time domain symbols.

18. The system of claim 16 wherein said first portion of said cyclic prefix has initially unknown length, said first cost function varies depending on said length and said synchronization system further varies said cyclic prefix length to optimize said first cost function.

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19. The system of claim 16 wherein said synchronization system determines optimal burst timing that will be optimal for all channel impulse response durations up to .

20. The system of claim 16 wherein said synchronization system determines a fractional component of a receiver frequency alignment as measured in a unit defined by spectral width of a single OFDM frequency domain symbol based on said burst timing alignment as varied to optimize said first cost function and on a second cost function that varies according to frequency alignment.

21. The system of claim 19 wherein each of said OFDM bursts include frequency domain training symbols at predetermined positions and having predetermined values; and wherein said synchronization system sets said integer component of said receiver frequency alignment so that said frequency domain training symbols are received at their predetermined positions.


22. A system for synchronizing a receiver to an OFDM signal comprising:

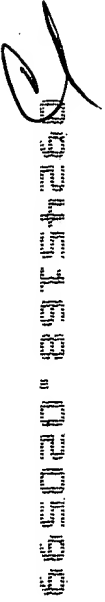
an OFDM receiver system that receives at least one synchronization OFDM burst wherein periodically spaced tones of said burst have values including non-zero values and tones between said periodically spaced tones have null energy; and

a synchronization system that evaluates a first cost function that varies depending on burst timing alignment, said first cost function measuring periodicity of said synchronization OFDM burst; and

wherein said synchronization system sets said burst timing alignment to optimize said first cost function.

23. The system of claim 22 wherein said synchronization system computes a receiver frequency offset based on said burst timing alignment that optimizes said first cost function.

 24. A system for synchronizing a receiver to an OFDM signal comprising:

 an OFDM receiver system that receives at least one OFDM synchronization burst wherein periodically spaced frequency domain symbols of said burst have values including non-zero values and frequency domain symbols between said periodically spaced frequency domain symbols have null energy; and

a synchronization system that determines burst timing alignment and frequency offset responsive to optimization of cost functions determined in response to contents of said at least one OFDM synchronization burst.

25. The system of claim 24 wherein at least one of said periodically spaced frequency domain symbols carries data.

